

Article title: It's time we talked about Charcot foot: Results of a podiatry patient education questionnaire.

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Article Points:

- Podiatrists routinely discussed signs of foot ulceration among all individuals with diabetic peripheral neuropathy.
- Contrary to consensus, Charcot foot education was more frequently provided to individuals 'In Remission' from this condition.
- Future approaches should empower all 'At-risk' and 'In Remission' individuals to check their feet regularly and contact specialist services in the event of 'danger signs.'
- Health care professionals have a responsibility to raise awareness of Charcot foot among vulnerable groups, in line with the principles of person-centred care.

Key Words:

- Charcot neuroarthropathy
- diabetic foot
- diabetic peripheral neuropathy
- patient education
- remission

Abstract:

Introduction: In contrast with diabetic foot ulceration (DFU) and lower extremity amputation (LEA), current Scottish patient information leaflets (PILs) reserve Charcot foot education for individuals 'In Remission' from, or with active, Charcot foot. A small group of Scottish National Health Service (NHS) podiatrists recently agreed Charcot foot education should be delivered to all 'At-risk' individuals with diabetic peripheral neuropathy (DPN). This study sought to compare diabetes foot disease (DFD) and Charcot foot discussion between 'At-risk' and 'In Remission' groups among this cohort. **Methods:** Fourteen participants completed an 'At-risk' component of the *Charcot Foot Patient Education Questionnaire*, while six also completed an 'In Remission' component. Topics investigated for both 'At-risk' and 'In Remission' groups included DFU- and LEA-risk, footwear and insoles and signs of infection and Charcot foot. Frequency of discussion data was captured with a five-point Likert scale, rated as Never (1); Rarely (2); Sometimes (3); Often (4) or Always (5). Median response and interquartile range (IQR) were described and compared between groups. **Results:** Median values and IQR for discussion of DFU- and LEA-risk were 5 (IQR: 1) and 3 (IQR: 1.25) respectively among 'At-risk' and 5 (IQR: 0.25) and 3 (IQR: 2) respectively among 'In Remission' groups. For discussion of footwear and insoles, the median response was 4 (IQR: 1) for 'At-risk' and 5 (IQR: 1) for 'In Remission' groups, reversed for discussion of signs of infection. The greatest between-group discrepancy was found for discussion of Charcot foot, with median responses and IQR found to be 3 (IQR: 2) and 5 (IQR: 0.25) for 'At-risk' and 'In Remission' groups, respectively. **Conclusion:** This discrepancy has potential implications for Charcot foot educational strategies, audit and research. It is proposed 'Always' should be the benchmark for frequency of Charcot foot education, not just for those 'In Remission' but also those 'At-risk.'

Introduction:

It is now over a decade since the Scottish Diabetes Foot Action Group (SD-FAG) introduced the *Diabetic Foot Risk Stratification and Triage* tool (Scottish Diabetes Group Foot Action Group 2010; **Figure 1**). Stratification of individuals based on predisposing risk factors, including diabetic peripheral neuropathy (DPN), peripheral arterial disease (PAD), active or previous diabetic foot ulceration (DFU) or previous lower extremity amputation (LEA), has since been supported by meta-analyses of extant DFU data (Crawford et al. 2015; Crawford et al. 2018). In 2008, annual diabetes foot screening was largely performed by NHS podiatrists, an approach deemed an inappropriate use of scant resources (Stang 2013). In an effort to bolster diabetes foot screening among non-podiatry health care professionals (HCPs), including assistant practitioners, nurses and medical professionals, the SD-FAG, together with The University of Edinburgh, subsequently delivered a national online *Foot Risk Awareness and Management Education (FRAME)* e-learning module (Scottish Diabetes Group Foot Action Group 2017). This framework shared annual diabetes foot risk stratification, education and triage with non-podiatry HCPs, integrating appropriate onward referral to podiatry services within a 'traffic light' matrix (Scottish Diabetes Group Foot Action Group 2010).

Figure 1: The original 'traffic light' *Diabetic Foot Risk Stratification and Triage* tool (Scottish Diabetes Group Foot Action Group 2010).

While the release of podiatry resources back into clinical care has, undoubtedly, benefited service providers, many individuals deemed to be at 'Low-risk' of DFD may now never see a podiatrist (Millard 2015). Standardised written and verbal education is, therefore, essential given the growing number of non-podiatry HCPs providing diabetes foot education. Individuals classed at 'Low-,'

‘Moderate-’ or ‘High-risk’ of DFD receive targeted patient information leaflets (PILs), explicitly focused on preventing diabetic foot ulceration (DFU) and lower extremity amputation (LEA). A 2016 update now considers individuals with a history of DFU, LEA or Charcot foot to be at the greatest risk, or ‘In Remission’ from DFD (Stang and Leese 2016). Individuals with a history of Charcot foot are particularly susceptible to DFU and LEA and up to 43% may develop Charcot foot again (Kucera et al. 2016).

The strengths of a standardised approach to diabetes foot education are tempered by the rigidity of material covered and, potentially, a lack of responsiveness to changing practice. A standardised, national strategy cannot easily be revised in light of emerging research evidence or evolving expert opinion, as evidenced by an eight-year gap between initial 2008 guidance and the 2016 revision. As an example, recent research from our group revealed podiatrists in one Scottish Health Board believed Charcot foot education should be delivered to all ‘At-risk’ individuals with diabetic peripheral neuropathy (DPN; Bullen et al. 2018). In contrast with DFU and LEA, current PILs reserve Charcot foot education for individuals ‘In Remission’ from, or with active, Charcot foot.

The relative rarity of Charcot foot may possibly contribute to the low levels of knowledge among non-specialist HCPs and further complicate ‘At-risk’ education efforts (Schmidt et al. 2017). It is therefore possible Charcot foot education is not routinely provided by non-podiatry HCPs during annual foot reviews. Despite the evolution of diabetes foot risk stratification and triage in Scotland and more frequent delivery of ‘Low-risk’ diabetes foot information by non-podiatry HCPs, podiatrists are still likely to be a key information resource for individuals with DPN, who are at least at ‘Moderate-risk’ of DFD.

Methods:

Charcot foot patient education practices among NHS and Academic podiatrists employed by a single Scottish Health Board were previously explored with modified Delphi methodology, achieving consensus after two rounds (Bullen et al. 2018). Following Queen Margaret University (QMU) Research Ethics Panel approval on 8th November 2016, all 86 podiatrists were invited to participate in this research, 14 of whom completed an initial *Charcot Foot Patient Education Questionnaire*. All participants consented to publication of their anonymised data. A key finding from this study was that, contrary to current guidance, podiatry respondents believed Charcot foot education should be delivered to all 'At-risk' individuals with DPN, not just those 'In Remission' from, or with active, Charcot foot. Given this response, this linked study subsequently sought to determine whether topics relevant to DFD and Charcot foot were differentially discussed between 'At-risk' and 'In-Remission' groups among this cohort, to benchmark current practice and inform future research, audit and educational initiatives.

A *Charcot Foot Patient Education Questionnaire* captured quantitative, self-reported frequency of discussion data with ordinal five-point Likert scales, rated as Never (1); Rarely (2); Sometimes (3); Often (4) or Always (5) (Bullen et al. 2018). Frequency of discussion of DFU-risk, footwear and insoles, signs of infection, signs of Charcot foot and LEA-risk were captured for 14 respondents managing 'At-risk' individuals with DPN, including six who also managed individuals 'In-Remission' from Charcot foot. Data sources for 'At-risk' and 'In Remission' groups were '*service users with diabetic neuropathy*' and '*service users with chronic diabetic Charcot foot,*' respectively. Descriptive frequencies for this ordinal data were described as the median response and interquartile range (IQR) for each group.

Results:

Fourteen of 86 podiatrists (16.3%) completed an 'At-risk' component of the *Charcot Foot Patient Education Questionnaire* (Bullen et al. 2018). While this response rate was low, it was comparable to a 15.8% response rate reported for a whole-workforce Delphi study of nurses employed by a Scottish NHS Health Board (Kirkwood et al. 2003). Median length of podiatric practice for all respondents was 15 years (IQR: 14.5 years). A subgroup of six podiatrists (7%) also completed an 'In Remission' component. These six individuals were comparable in terms of length of podiatry experience (median: 14.5 years; IQR: 12.75 years) to the eight podiatrists not involved in Charcot foot management (median: 18 years; IQR: 22 years).

Frequency of discussion data was compared between all 14 respondents involved in 'At-risk' diabetes foot education and the subgroup of six podiatrists also involved with educating 'In Remission' groups. Median responses and IQR for discussion of DFU-risk were comparable between 'At-risk' and 'In-Remission' groups. The median response for DFU-risk discussion was 5 (IQR: 1) among 'At-risk' and 'In Remission' groups (IQR: 0.25). For discussion of LEA-risk, a median response of 3 was found for both groups, with IQRs of 1.25 and 2 for 'At-risk' and 'In Remission' groups, respectively.

For discussion of footwear and insoles, the median response was 4 (IQR: 1) for 'At-risk' and 5 (IQR: 1) for 'In Remission' groups. These results were reversed for discussion of signs of infection, with a median response of 5 (IQR: 1) for 'At-risk' and 4 (IQR: 1) for 'In Remission' groups. The greatest discrepancy was found for discussion of signs of Charcot foot, with median responses of 3 (IQR: 2)

and 5 (IQR: 0.25) for 'At-risk' and 'In Remission' groups, respectively. Median and IQR values for frequency of discussion data for both 'At-risk' and 'In Remission' groups are summarised in **Figure 2**.

Figure 2: Median frequency of discussion and IQR of DFU-risk, footwear and insoles, signs of infection, signs of Charcot foot and LEA-risk between individuals 'At-risk' of, and 'In-Remission' from, Charcot foot.

Key: 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Always; AR = individuals 'At-risk' of Charcot foot; CF = signs of Charcot foot; DFU = DFU-risk, EXP (YRS) = length of podiatric experience (in years); FW = footwear and insoles; INF = signs of infection; IR = individuals 'In-Remission' from Charcot foot; LEA = LEA-risk.

Small participant numbers and the absence of *a priori* sample size calculations limit the applicability of inferential statistics. While no claims of statistical significance or generalisability to populations beyond research respondents are made, related-samples Wilcoxon signed-rank tests were undertaken with *IBM SPSS Statistics 23* (IBM 2019) to help determine if between-group differences were likely to be statistically significant and to inform future audit and research. Wilcoxon signed-rank testing did not suggest educational practices differed between 'At-risk' and 'In Remission' groups in terms of discussion of signs of infection ($p=1$); footwear and insoles ($p=0.414$); DFU- or LEA-risk ($p=0.157$). Discussion of Charcot foot, however, was more frequent among 'In Remission' groups ($p=0.026$), a finding that may well be clinically significant, with implications for knowledge and understanding among 'At-risk' groups.

Discussion:

In Scotland, podiatry and non-podiatry HCPs have successfully shifted our thinking from 'foot examination' to 'risk stratification' (Stang 2013). The time is now to move away from foot risk stratification towards truly person-centred care. As author (MY) recently stated (Young 2018), p. 216, *"screening for increased risk of foot ulceration only predicts a group of individuals who have a 3–5% chance of developing foot ulceration in the next year"* (Young et al. 1994; Crawford et al. 2011), observing *"the biggest effect on improving outcomes in patients at risk of foot ulceration appears to be due to earlier referral of new ulceration to multidisciplinary foot ulcer clinics (MDFC) for those patients who are known to the foot protection team. Being reviewed by a podiatrist, and even better if the patient then self refers to the MDFC, ensures that the ulcers are less severe when first seen in the MDFC"* (Young 2018), p. 217.

The results of this study suggest Charcot foot signs are frequently discussed by podiatrists managing individuals 'In Remission' from this condition, however, are discussed less frequently among those 'At-risk.' A strength of this research was the anonymity afforded to participants, promoting honest responses. Given the small number of respondents, only six of whom responded to questions concerning 'In-Remission' individuals, these results must be interpreted with caution. Furthermore, this study only considered the educational practices of NHS podiatrists employed by, or holding honorary contracts with, a single Scottish Health Board and cannot, therefore, be extrapolated to private podiatrists or the wider profession. Throughout Scotland, NHS podiatry service redesign has meant many 'Low-risk' individuals are not routinely reviewed by an NHS podiatrist and instead seek voluntary or private services for regular foot care. Research concerning the educational practices of larger, more representative populations, including volunteer and private practitioners is, therefore, warranted.

Of further note, is the relatively narrow range of topics evaluated. Respondents were not asked whether they provide emergency podiatry or MDFC contact information, promoting “*rapid access to emergency foot care services when required*” (Leese et al. 2011), p. 69. While this research suggests signs of Charcot foot are discussed among ‘At-risk’ and ‘In Remission’ groups, it is not yet known whether these individuals are also supplied with NHS podiatry or MDFC contact details, in the event of ‘danger signs.’ Despite these limitations, this data sets a benchmark for future audit and research, which may take into account wider podiatry and non-podiatry educational practices and the impact of Charcot foot understanding among ‘At-risk’ and ‘In Remission’ groups.

Conclusion:

While Charcot foot education was found to be routinely delivered to people with a history of this condition, the same could not be said for those ‘At-risk.’ This discrepancy may well have implications for Charcot foot knowledge and understanding among people with DPN. If signs of Charcot foot are not routinely discussed, individuals may not know what to look for and who to contact in the event they develop ‘danger signs.’ Whilst it may be that DFU cannot be prevented with targeted educational initiatives, it appears that the severity of disease can be halted with timely MDFC self-referral (NHS Digital 2018). This wisdom likely also holds true for the Charcot foot.

Rather than aiming to prevent Charcot foot, a more realistic approach should empower individuals ‘At-risk’ of, or ‘In Remission’ from, this condition to check their feet regularly, recognise the early signs and contact the MDFC immediately. In 2019, it is argued, it’s time we talked about Charcot foot with all those we care for with DPN, not just those with Charcot foot experience. Future

research is needed to determine levels of knowledge, understanding and health literacy among 'At-risk' and 'In Remission' groups and whether early recognition of the classic red, hot and swollen Charcot foot and timely self- or podiatry-referral to the MDFC prevents the devastating sequelae associated with delayed offloading.

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